

September 11, 2006

TO: D. Morris

FROM: A. Andujo

SUBJECT: Magnetospheric Multiscale Support Study

This study is in response to a request from Magnetospheric Multiscale (MMS) project management. The purpose of this study is to evaluate the DSN's ability to schedule the four-spacecraft MMS mission during October 2013 to December 2015. This study used a nominal requirement of 2.5 tracking hours per day for all 4 spacecraft from October 2013 – June 2015 and 4.5 tracking hours every 3 days for all 4 spacecraft from July 2015 – December 2015.

### **Assumptions**

Reference information including the updated mission set database from the August 2006 Resource Allocation Review were used to forecast tracking support for MMS. (See figure 1)

The analysis was performed using one 40 minute pass per spacecraft per day during the period of October 2013 – June 2015. For period of July 2015 – December 2015, one 75 minute pass per spacecraft per day was used because we would not know which day of the three day orbit the support would occur and this provides better forecasting information. There are two antennas at each DSN complex that can support 2-way Category-A S-band communication.

As there are no viewperiods available yet for this mission, an all sky viewperiod was used to perform this study. However due to the proposed low-Earth orbit tracking of the mission by the DSN, it is speculated that DSN view and resultant tracking of the constellation will be limited due to the speed and orbit of the spacecraft.

There is no planned antenna downtime in this period, yet there is a DSN maintenance plan in place to take every antenna offline for approximately one month for Depot Level Maintenance. Typically, antenna downtime is planned within 3 – 4 years; therefore it is too early to determine the impact of downtime in this period.

### **Summary of Results**

The results of this study indicate an average supportable percentage 96% (See figure 2 and 3). The Mars 2013 Orbiter (M13O) appears to be the prime mission to affect support at this time. Based on the current information the DSN is capable of supporting the MMS Mission with little or no contention. Since this mission will be supported primarily during perigee, there are three other antenna constraints that may limit support: Antenna Slew Rate Limits, Antenna Keyholes, and Antenna Cable Wrap.

As always, the results of this study are subject to change, in that network loading changes as requirements for planned missions are input and updated and periods of antenna downtime are identified. We will continue to work with MMS and other users of the DSN to maximize the time available for each individual user.

Figure 1: DSN Advanced and Ongoing Mission Set 2013 - 2015

Project	Acronym	Launch or Start	EOPM	EOEM	Advanced or Ongoing	2013	2014	2015
Advanced Composition Explorer	ACE	08/25/97	02/01/01	10/01/13	O			
Chandra X-Ray Observatory	CHDR	07/23/99	07/24/09	07/24/14	O			
Dawn	DAWN	06/20/07	07/04/15	TBD	O			
DSN Antenna Calibration	DSN	--	--	--	O			
DSN ZDD Calibration	DSN	11/01/04	--	--	O			
DSS Maintenance	DSS	--	--	--	O			
European and Global VLBI Systems	EGS	--	--	--	O			
Goldstone Solar System Radar	GSSR	04/01/85	--	--	O			
Ground Based Radio Astronomy	GBRA	--	--	--	O			
Mars Reconnaissance Orbiter	MRO	08/12/05	12/31/10	12/31/15	O			
New Horizons	NHPC	01/17/05	04/17/16	TBD	O			
Reference Frame Calibration (Cat M&E and Clock Sync)	DSN	--	--	--	O			
Rosetta	ROSE	02/26/04	12/31/15	- - -	O			
Space Geodesy	SGP	--	--	--	O			
Spitzer Space Telescope (SIRTF)	STF	08/25/03	05/31/09	05/31/14	O			
James Webb Space Telescope	JWST	06/01/13	07/31/16	TBD	A			
Juno	JUNO	07/08/10	09/18/16	TBD	A			
Mars Orbiter 2013	M13O	11/28/13	08/21/16	TBD	A			
Mars Scout 2011	M11L	01/31/12	09/10/14	TBD	A			
Space Interferometry Mission	SIM	03/13/11	09/13/16	09/13/21	A			



Prime Mission =   
Extended mission = 

Figure 2: MMS Support Forecast 2013 - 2014

**MMS Mission Support Forecast 2013 - 2014**

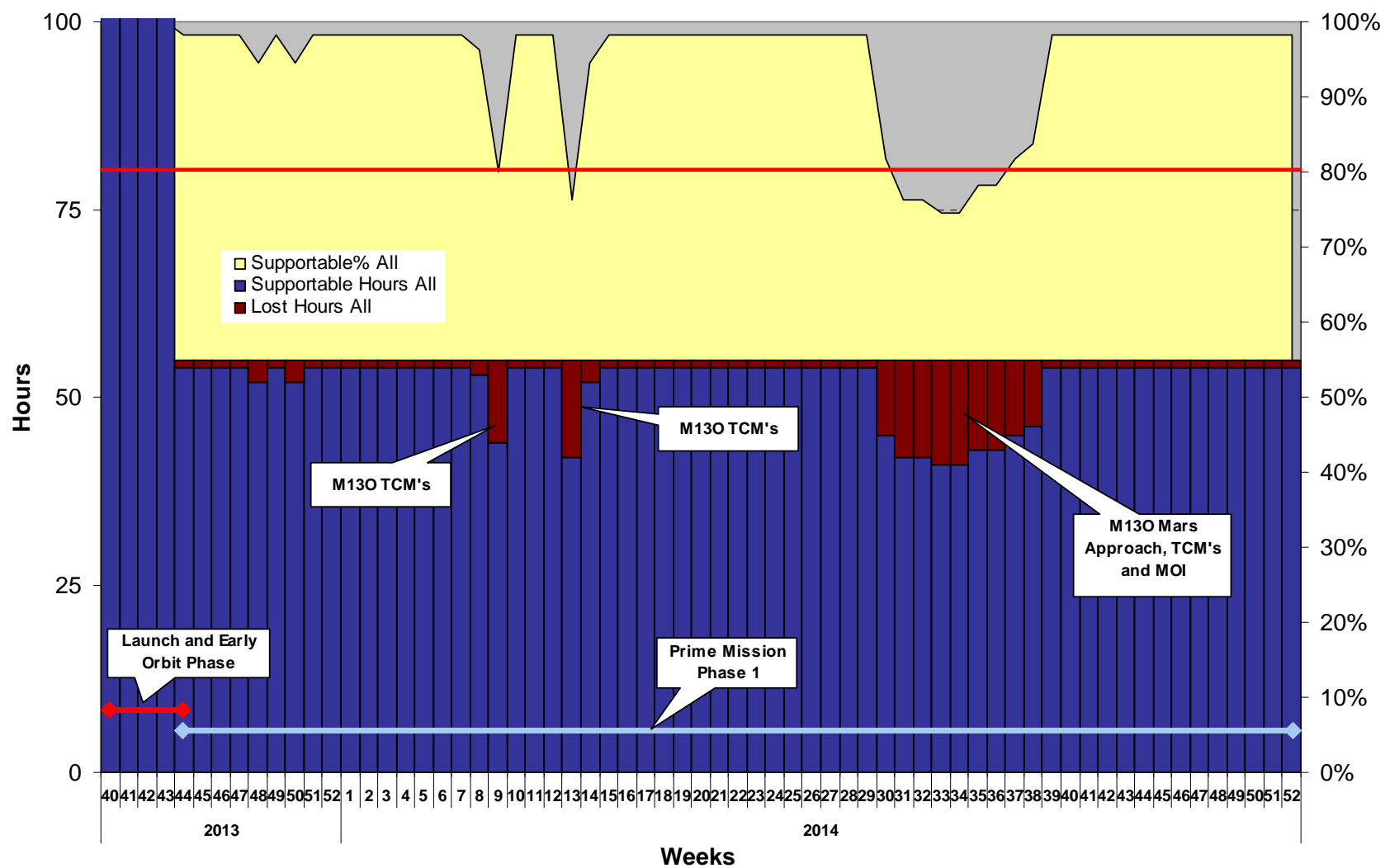


Figure 3: MMS Support Forecast 2015  
**MMS Mission Support Forecast 2015**

